1: Bowen-Jones et al. K-5 (1955-1958) 1961
EZ6 Malta EZ6

feet, is in southern Malta near Marsaxlokk (5965) and the thinnest, about 75 feet, is below Fort Chambray (3686) in southern Gozo. In general it is thinnest along a line passing north-south through the Comino Straits. 133

The Globigerina Limestone is a fine-grained white to buff calcarenite completely composed of calcareous tests of globigerinids, anomalinids, and other small foraminiferans. Within the formation are developed horizons of phosphatic nodules, usually very thin, and two of these extend throughout the islands and enable a subdivision to be made into lower, middle and upper divisions. These horizons are composed of individual nodules ranging from less than pea size to several inches in diameter. They range in colour from black through dark brown to green and are largely composed of collophane with up to 40 per cent. phosphate of lime in the lower beds.

One of the best exposures of the whole succession is seen near Fomm ir-Rih (4073) on the western coast of Malta. There the Middle and Lower Globigerina Limestone is best seen on the upthrown side of the Victoria Lines Fault at Fomm ir-Rih itself whilst the Upper Globigerina Limestone and the junction with the Blue Clay is seen 1,300 yards to the north-west. The succession is as follows:-

	Feet
3. Blue clay -	seen to 178
2. Globigerina Limestone	
(iii) Upper Globigerina Limestone	
Yellow-orange fine-grained and honeycomb-weathering limestone with abundant pteropods and scattered ferruginous nodules -	23
Light-grey/blue argillaceous marl -	25
Yellow, friable and jointed fine-grained limestone with scattered ferruginous nodules -	28
Yellow limestone as above but with several phosphatic seams (one is developed at Fomm ir-Rih and there forms a marked projecting cornice) -	9
(ii) Middle Globigerina Limestone	
Phosphatic nodule bed with limestone pebbles and abundant corals, fish teeth and other fossils, the whole passing irregularly down into the bed below -	3/4
Light grey to intensely white-weathering chalky limestone with khaki-hearted cherts in the middle portion: several thin nodule seams within it, two well marked ones lie 14 feet and 19 feet above the base -	139
(i) Lower Globigerina Limestone	
Phosphatic nodule bed forming a massive ledge with ferruginous and phosphatic nodules and abundant casts of fossils and fish teeth, etc. -	1
Fine grained yellow limestone with abundant *Pecten* spp. and Bryozoa -	3
Bryozoan and foraminiferan rock -	4
1. Lower Coralline Limestone	
Dense crystallised limestone forming sheer cliffs below -	100

The widespread *Scutella* graveyard, which is not well developed at Fomm ir-Rih, suggests that in upper Lower Coralline Limestone times the sea floor was nearly flat. During the deposition of the Lower and Middle Globigerina Limestone a zone of lesser sedimentation stretched through the Comino Straits while greater accumulation took place in a basin near Valletta and in western Gozo.

(i) Lower Globigerina Limestone: This division is typically a yellow, fine grained, occasionally fucoidal limestone, usually unbedded. It varies from a few feet in thickness, as at Fomm ir-Rih, to more than 300 feet near Valletta. 133 316

133 [316] Malta, and over 70 feet in western Malta. It provides the most important building stone on the islands, the 'franka', which is a very easily cut freestone which is worked in large, vertical sided quarries especially around Mqabba, Malta (5267), Sannat, Gozo (3186) and north of San Lawrenz (2891). The franka when used for exterior work weathers well. The stone develops a tough outer layer but in time this often exfoliates and weathers in a curious honeycomb manner. There are abundant fossils in this division the commonest being *Flabellipecten*, *Schizaster* and *Eupatagus*.

A ubiquitous phosphatic nodule bed, varying from a few inches to three feet in thickness, marks the upper limit of the division. Within the limestone there are other seams of phosphatic nodules of only local distribution. There are two such near Naxxar (4974) at 40 feet and 90 feet above the base. The upper phosphatic nodule bed (bed G of Cooke 1896, p. 502) yields abundant fossils including the teeth of a giant shark *Carcharodon megalodon* and of the seal *Phoca rugosidens* and also *Stereodon*, *Notidanus* and *Odontaspis*. There are also corals, *Trochocyathus* spp., pectens and echinoids.

(ii) Middle Globigerina Limestone: The white marly limestones of this division which follow above the nodule bed at the top of the Lower Globigerina Limestone are everywhere readily distinguishable from the beds below in colour and lithology. The division is absent in eastern Gozo but increases to 150 feet near Rabat, Malta, and 390 feet in Marsaxlokk Bay (5965) where the series is very well exposed. Within this rather monotonous series several minor horizons of dispersed phosphatic nodules occur locally in west and central Malta. Also khaki-hearted cherts are developed in the lower portion and these form a prominent feature inland one mile south-west of Siggiewi, Malta (4967). A widespread phosphatic nodule bed marks the upper limit of this division and below this in western Gozo is a coarse yellow limestone unit.

The sparse fauna found within the Middle Globigerina Limestone includes the typical Langhian or Burdigalian nautiloid *Aturia aturi*. Also there are the echinoids *Brissopsis* and *Schizaster* and several pectens. Of particular interest are the remains of the turtle *Tryonx melitensis* and the crocodile *Tomistoma*.

(iii) Upper Globigerina Limestone: The upper nodule bed at the top of the Middle Globigerina Limestone is followed by a return to yellow and coarser beds similar in lithology to the Lower Globigerina Limestone. This division does not show the same pattern of thickness variation as the two lower divisions. Typically it is 70-80 feet thick but expands southwards and at Delimara Point in south Malta (6064) there is at least 140 feet.

This division can be farther divided in many places into three parts: a lower, yellow, fine grained limestone, a light blue marly and argillaceous division, and an upper, fine grained yellow limestone with common pteropod casts and honeycomb weathering. 317] When well exposed, the junction with the Blue Clay above is always clearly seen and it is difficult to understand why a contrary view is so widespread in the literature.

3. The Blue Clay

This formation, often called the 'Maltese Clays and Marls' or the 'Clays and Marls', lies conformably upon the Globigerina Limestone. It is a series of blue and yellow clays and marls, yielding selenite, up to 230 feet in thickness but at times thinning out completely. The clay is of considerable importance as a seal to the Upper Coralline Limestone and Greensand aquifer and has been used for pottery.

There has been considerable dispute as to the cause of the thinning of the Blue Clay. Murray and Cooke considered it was due to pressure of the Upper Coralline Limestone above leading to superficial 'bulging'. This is clearly a factor in most places, but in certain regions the Greensand and Upper Coralline Limestone may rest directly on the Middle and Lower Globigerina Limestone on a scale too vast to be interpreted as due either to 'bulging' or to removal by erosion of the intervening clay. In particular around San Anard (5970), two miles south-east of Valletta, the Upper Coralline Limestone transgresses northward over much of the Middle Globigerina Limestone and finally rests on the Lower Globigerina Limestone within half a mile.

Within the clay, rounded grains of quartz, augite, felspars and tourmaline have been recorded (Cooke 1893) and the fossils include pectens and *Aturia aturi*. These are of pelagic habit and similar to those typical of the true 'schlier' facies. 133

4. Greensand

The greensand is a coarse, orange-brown, thick bedded fragmental limestone which usually forms the base to the Upper Coralline Limestone cliffs. In the unweathered state an abundance of glauconite gives the rock a green colour. The thickness reaches a maximum of 50 feet in south-west Malta but it is usually about half this figure. In other places the formation is absent. The boundary with the Blue Clay below is very abrupt and, around the coasts, landslips commonly begin there. The upper boundary is often more difficult to define.

Frequently the rock is full of giant Foraminifera and has been termed a 'Heterostegina Rock' (Murray, 1890). Such developments are common on Gozo and near Dingli, Malta (4468). The formation has yielded a very rich echinoid fauna including *Clypeaster*, *Heteroclypeus* and *Echinolampas* together with shark teeth and the remains of dugongs, manatees, dolphins and whales.

5. Upper Coralline Limestone

This is the youngest Tertiary formation in the islands. Generally it caps the highest hills but, especially in northern Malta, faults bring it down to sea level. On Comino a thickness of some 250 feet is exposed and 530 feet was penetrated in a borehole near the centre of the Binġemma Syncline (4374) without reaching the bottom. Usually only about 100 feet is preserved on the high land. The rock varies considerably. Frequently it is composed of large growths of the coralline alga *Lithothamnium* with marly partings between the growths. In places it is a dense crystalline limestone and elsewhere there are thick marly seams rich in fossils. Compact limestone predominates, however, and it is usually poorly bedded. On Gozo the stone has been quarried as 'Gozo Marble' which is hard, red to yellow in colour and taking a good polish. Petrologically the formation is very similar to the Leithakalke of the Vienna Basin with which it has been correlated (Fuchs 1874). [316]

Fossils other than algae are locally abundant and they include the echinoids *Cidaris*, *Clypeaster*, *Schizaster*, *Echinus*, *Brissus* and *Echinolampas* together with abundant Foraminifera and large molluscs.

PLEISTOCENE AND RECENT DEPOSITS

These deposits may be conveniently divided into first, the valley loams and sands, second, the coastal conglomerates and breccias, third, the bone deposits in caves and fissures and finally the prehistoric remains.

The only widespread areas of valley deposits with stratified sands, loams and gravels of fluviatile origin are in the valley areas behind Mellieħa, St. Paul's, and Salina Bays.

Conglomerates and coastal breccias, often with Pleistocene Mollusca, occur in small patches around the Marfa Ridge, St. Paul's Bay, Mellieħa Bay, Għar Lapsi, Benġħisa Point (5863) and St. Thomas Bay (6067). They usually form a moderately cemented rock composed of local material (Trechman 1938).

The Pleistocene ossiferous deposits, filling caves and fissures in the limestones, have yielded numerous interesting animal remains. The Għar Dalam Cave (5765) is the most celebrated but there are others at Qrendi, Żebbuġ, Mellieħa and Malak. The oldest faunas include Pleistocene dwarf hippopotomi, pygmy elephants, dormice and swans and a later deposit has horse and deer.

Stone Age remains include 15 temples, the best of which is perhaps Tarxien, Malta (3689) which has provided vessels and amulets as well as statuettes of grotesquely fat divinities (Zammit 1930), but others are very fine, especially Ħaġar Qim, Malta (4965) and Ġgantija, Gozo (3489). There is also a three-storied Hypogeum at Pawla. The complex system of cart tracks, with cross roads and junctions, are probably also of neolithic age. A detailed cultural sequence based on potsherds has recently been described by Evans (1954, 1959). 172

1: Bowen-Jones et al. K-5 (1955-1958) 1961
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Plate XV. Worked-out quarry in the Naxxar-Gharghur Hills. Spring. Vines cultivated at various levels.

*311

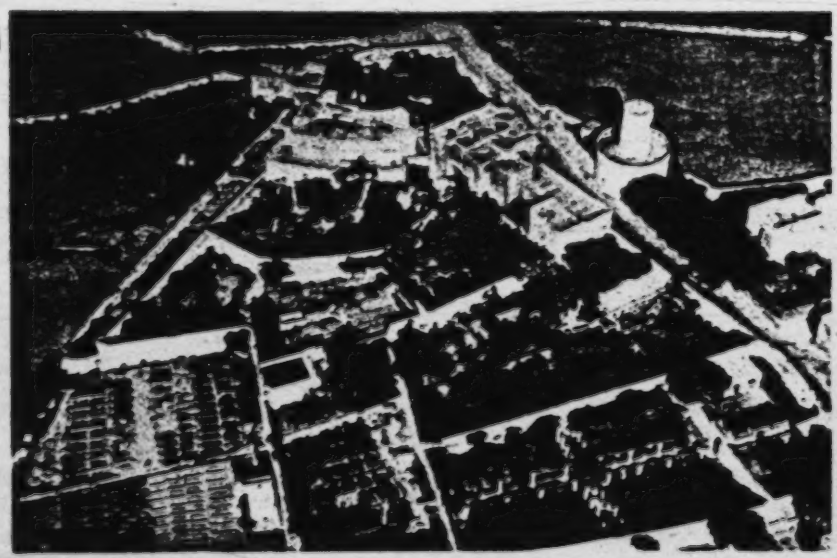

Plate XVI. Walled orchards and gardens south of Naxxar. Summer. The circular building in the middle distance is an old windmill.

1: Bowen-Jones et al. K-5 (1955-1958) 1961
EZ6 Malta EZ6
Malta

*241
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102
134

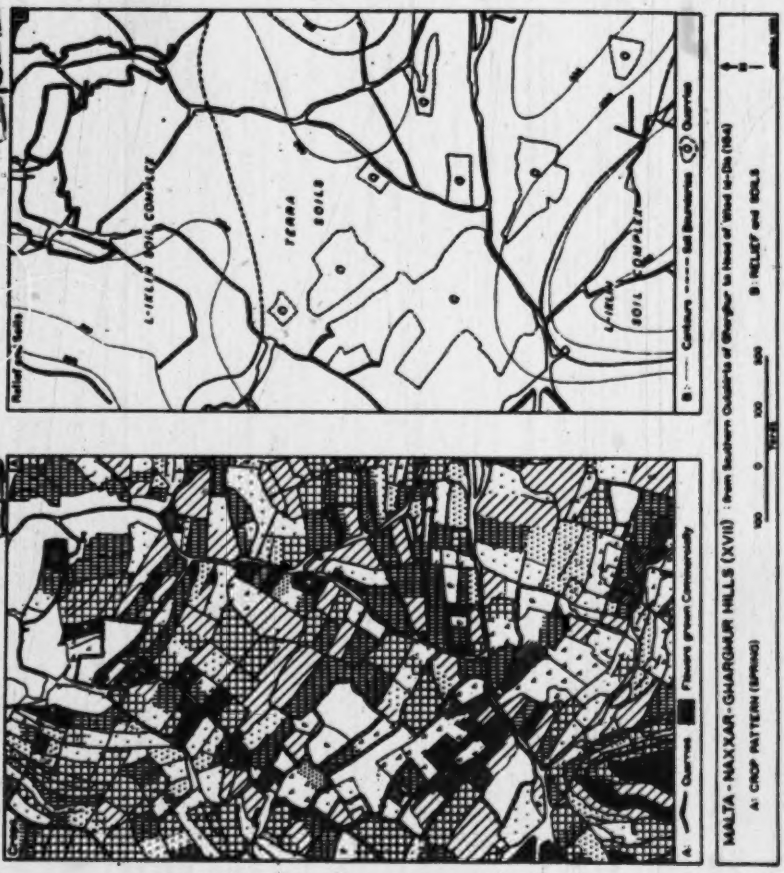

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Fig. 118 Malta: Naxxar-Gharghur Hills.

1: Bowen-Jones et al. K-5 (1955-1958) .1961
EZ6 Malta EZ6

On the spur of Ghar Ram (199) and tal-Mandaq (200), the intensity of cultivation decreases eastward, cereals and sulla becoming dominant. The even slopes of tal-Mlas (198) drop northward to the more level Ghammieri district of the Wied is-Sewda. Gradient has little effect on the selection of crops grown in these areas. Cereals and sulla dominant throughout although potatoes assume a greater importance than on the summit. In contrast the southern edge of the ridge is more abrupt, falling sharply to the Wied Qirda. Precipitous terraces, standing above a storm-water channel cut in Lower Coralline rocks are almost completely abandoned. The only pocket of fruit cultivation in this region lies in the Wied Qirda above the main incision and close to Żebbuġ.

Scattered settlement of farmsteads and a few small hamlets is generally aligned along roads and tracks. The great majority of the land-holders, however, live in the casal of Żebbuġ which combines some urban functions with those of village settlement.

XVIII (d). THE SIĠĠIEWI REGION

In many ways this region is a counterpart of that of Żebbuġ. The high plains west of Siġġiewi sweep south from ta'Brija (133) to tal-Bajjada to merge with the open Rdum tal-Lunzjata. Intensive dry-farming of cereals, sulla and vegetables is characteristic. Onion cultivation is of particular importance here as throughout the region.

From this western platform, the ridges of tal-Bordin (135), tal-Ghaqba (205) and ta'Haxxluq carry relatively high land to the east. Tal-Bordin is noteworthy only for the absence of early potatoes, possibly because of its rather exposed position. The place-name element *nadur*, meaning a look-out point, is significantly attached to the fields on this small ridge. The main ridge of tal-Ghaqba, carrying a variety of crops, is generally similar to tal-Mandaq on the other side of Wied Qirda. The crop range is similar on ta'Haxxluq ridge, though the fields are generally smaller and the country more broken (see Fig. 119). In these eastern districts, the commercial farming element is most strongly represented by onion growing which is even more extensive here than around Żebbuġ.

Siġġiewi itself was established on the south-western edge of the central settlement zone of Malta. The casal and outlying farmsteads were to some extent influenced by the need for protection from corsair raids. Walled enclosures and a few defensive towers indicate past insecurity. Siġġiewi still lies off the busiest lines of communication and the south-western part of the region is one of the least accessible districts of the central lands of Malta. Here, small hamlets cluster around isolated churches as at tal-Providenza (150).

XVIII (e). THE QORMI REGION

The district around Qormi is atypical of the Central Region as a whole. A considerable number of motor-driven pumps extract water from the fault-fissured Globigerina beds and irrigable land constitutes a large proportion of the total area. Vegetable and fruit crops, the latter including citrus and even such exotics as the banana are grown intensively in this sheltered district (Fig. 120). The Qormi basin is a westward continuation of the Marsa lowland, an area of alluvial deposition (see Chapter II). Large farms with irrigated gardens surround the large casal (Fig. 117B).

C.XIX. THE SOUTHERN REGION

A highland ridge with an average altitude of more than 400 feet extends eastwards from the Upper Coralline scarp at Lunzjata along the southern coast as far as Buleqra. Further east and towards the interior of the island, the land falls away in gentle slopes. Although true wasteland is confined to a coastal belt coinciding with outcrops of Lower and down-faulted Upper Coralline beds, much land has elsewhere been taken out of cultivation. The airfields of Luqa and Hal Far, still in use and their as yet un-reclaimed wartime extensions, together with large-scale quarrying on either side of Mqabba, have sterilised a great deal of land.